CLAIMS

1. A flat microlens wherein:

said microlens is formed using a transparent DLC film;

said DLC film includes a region with graded refractive indices; and

when a light beam passes through said region with graded refractive indices, said light beam is focused.

2. A flat microlens according to claim 1 wherein:

a refraction lens region with a relatively high refractive index is formed on a first main surface of said DLC film; and

said lens region includes a convex lens formed from said first main surface and a surrounding boundary surface corresponding to part of a roughly spherical surface.

3. A flat microlens according to claim 1 wherein:

a refraction lens region with a relatively high refractive index is formed on said first main surface to correspond with each of said microlenses; and

said lens region has a shape of a columnar convex lens formed from said first main surface surrounded by a boundary surface corresponding to a part of a roughly cylindrical surface with a central axis parallel to said main surface.

4. A flat microlens according to claim 1 wherein:

a refraction lens with a relatively high refractive index is formed on said DLC film corresponding to each of said microlenses;

said lens region has a roughly cylindrical shape that passes completely

through said DLC film; and

a central axis of said cylindrical shape is perpendicular to said DLC film, with higher refractive indices near said central axis.

5. A flat microlens according to claim 1 wherein:

a refraction lens with a relatively high refractive index is formed on said DLC film corresponding to each of said microlenses;

said lens region is a band-shaped region passing completely through said DLC film; and

refractive indices are higher near a plane passing through a midpoint of a width axis of said band-shaped region and perpendicular to said DLC film.

6. A flat microlens according to claim 1 wherein:

said DLC film includes a plurality of concentric band-shaped ring regions;

refractive indices of said band-shaped regions are graded relative to each other so that said band-shaped ring regions act as a diffraction grating; and

widths of said band-shaped ring regions decrease as a distance from a center of said concentric circles increases.

7. A flat microlens according to claim 6 wherein:

said DLC film includes m concentric ring zones, each of said ring zones containing n band-shaped ring regions;

in each of said ring zones, inner band-shaped ring regions have higher refractive indices than outer band-shaped ring regions; and

corresponding band-shaped ring regions in different ring zones have identical refractive indices.

8. A flat microlens according to claim 1 wherein:

said DLC film includes a plurality of parallel band-shaped regions;

refractive indices of said band-shaped regions are graded relative to each other so that said band-shaped regions act as a diffraction grating; and

a width of said band-shaped region decreases as a distance from a predetermined band-shaped region increases.

9. A microlens according to claim 8 wherein:

said DLC film includes m concentric band zones, each of said band zones containing n band-shaped regions;

in each of said band zones, band-shaped regions closer to said predetermined band-shaped region have higher refractive indices than band-shaped regions that are further away; and

corresponding band-shaped regions in different band zones have identical refractive indices.

10. A flat microlens according to claim 1 wherein said microlens can act as a lens for light containing wavelengths in a range from 0.4 microns to 2.0 microns.

11. A method for making a flat microlens according to claim 1 wherein said DLC film is formed using plasma CVD.

12. A method for making a flat microlens according to claim 11 wherein a refractive index of a region in said DLC film with a relatively high refractive

index can be formed by increasing refractive index through application of an energy beam to said DLC film.

13. A method for making a flat microlens according to claim 12 wherein said energy beam application can include ultraviolet radiation, X-ray radiation, synchrotron radiation, ion beam radiation, and electron beam radiation.

14. A method for making a flat microlens according to claim 12 wherein a plurality of microlenses arranged in an array on a single DLC film is formed simultaneously by applying an energy beam.